

**MATHEMATICS: SPECIALIST 3 & 4**

**EXTENDED PIECE OF WORK 4**

**PART B**

# HYPERBOLIC FUNCTIONS

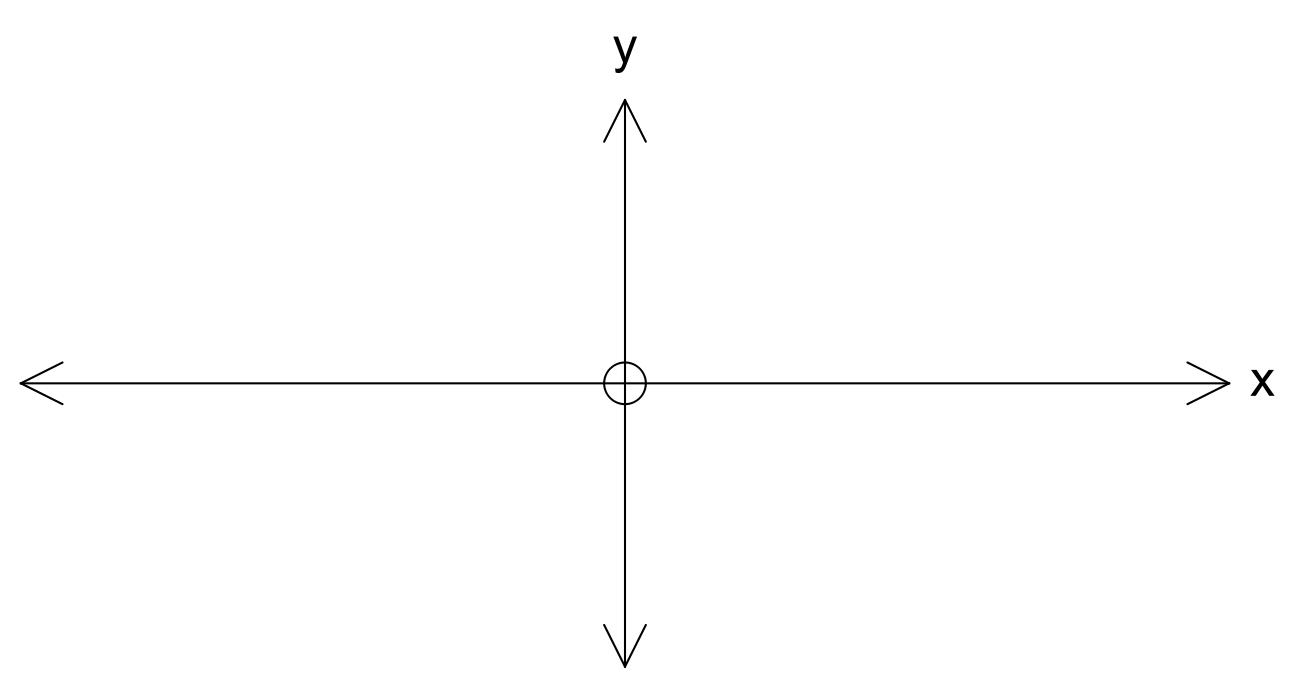
Time Allowed: 55 minutes Total Marks: 40

No calculators allowed. Part A may be used for this Part.

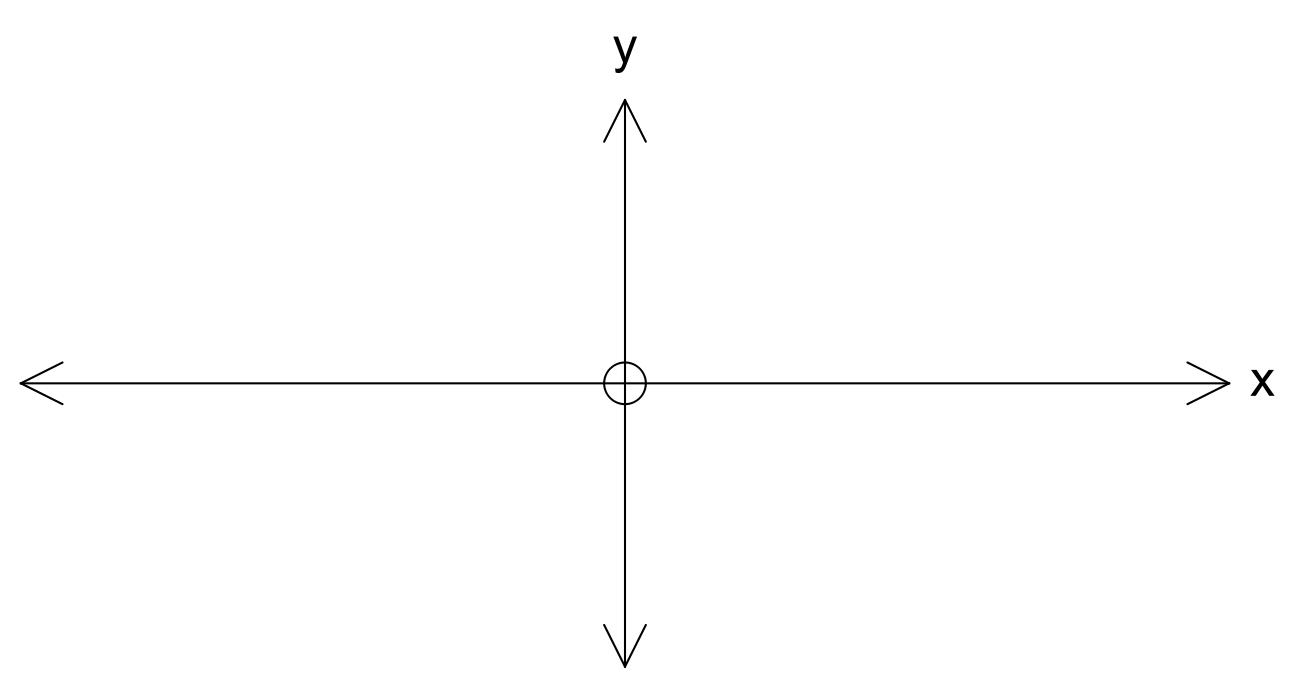
**1.** [6 marks]

Sketch the following graphs. Show any important points on the axes.

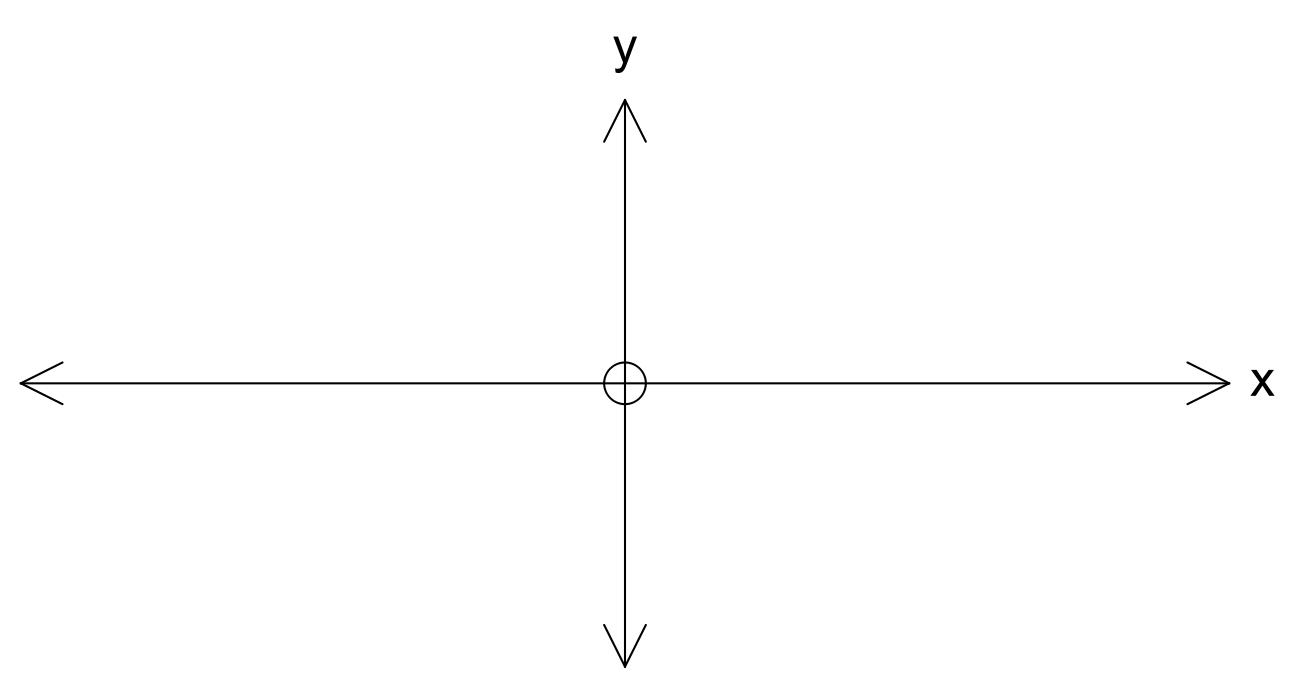
(a)



(b) , where



(c)



**2.** [4 marks]

State whether each of the following are true or false.

(a) For large and positive, and have approximately the same value.

(b)

(c)

(d) For and large, the graph of approximates the curve .

**3.** [7 marks]

Use the transformation suggested in Question 4 of your assignment to transform the following identities into identities involving hyperbolic functions.

(a)

(b)

(c)

(d)

**4.** [4 marks]

Given , show that .

[Hint: use Question 2 (a) from Part A]

**5.** [6 marks]

Use the results from Question 2 (c) in Part A to prove

**6.** [7, 6 marks]

(a) Find

(i)

(ii)

(iii)

(iv)

(b) Show that

[Hint: Use Question 1 (b) from Part A and the quotient rule]